Claims

1. A method for performing a planarization process, comprising the method operations of:

providing an annular ring having a matrix layer containing an abrasive material adhered to a compliant layer, the compliant layer affixed to the annular ring;

transforming a portion of the compliant layer to a less compliant state;

grinding a surface of a substrate with the abrasive material.

2. The method of claim 1, wherein the method operation of grinding a surface of a substrate with the abrasive material includes,

rotating the annular ring about an annular ring axis;

applying a downward force to the annular while rotating the annular ring, the downward force causing the abrasive material to be forced against the surface of the substrate.

3. The method of claim 1, wherein the method operation of transforming a portion of the compliant layer to a less compliant state includes:

applying an electromagnetic field to the portion of the compliant layer.

4. The method of claim 1, wherein the compliant layer is a membrane surrounding one of a magnetorheological fluid and a magnetorheological polymer.

5. The method of claim 1, wherein the matrix layer is non-contiguous.

6. The method of claim 1, wherein the method operation of grinding a surface of a substrate with the abrasive material includes,

rotating the annular ring and the substrate in a same rotation direction.

7. A substrate grinding device, comprising:

an annular ring;

a first layer disposed over a surface of the annular ring, the first layer configured to alternate between a compliant state and a rigid state; and

a second layer disposed over the first layer, the second layer including an abrasive component configured to grind a surface of a substrate.

8. The substrate grinding device of claim 7, further comprising:

a shaft connected to the annular ring, the shaft having an axis coincident with an axis of the annular ring.

9. The substrate grinding device of claim 7, further comprising:

an electromagnetic field generator configured to generate an electromagnetic field proximate to at least a portion of the first layer.

10. The substrate grinding device of claim 7, wherein the first layer includes a membrane surrounding a fluid.

11. The substrate grinding device of claim 7, wherein the second layer includes diamonds disposed within a matrix, a portion of the diamonds protruding out of a bottom surface of the matrix.

12. The substrate grinding device of claim 10, wherein the fluid is one of a magnetorheological fluid and a magnetorheological polymer.

13. The substrate grinding device of claim 7, wherein the abrasive component is segmented.

14. A pre-planarization module configured to perform a long range planarization operation, comprising:

a semiconductor substrate support configured to rotate about a first axis; and

an annular ring having a first side of a compliant layer affixed thereto, a second side of the compliant layer affixed to a planarizing surface, the annular ring configured to move perpendicular and parallel to a plane associated with the substrate support, the annular ring further configured to rotate about a second axis, the second axis being offset from the first axis, wherein the substrate support and the annular ring rotate in a same direction.

15. The pre-planarization module of claim 14, wherein the compliant layer is a bladder filled with a fluid, the fluid configured to alternate between a compliant state and a less compliant state

16. The pre-planarization module of claim 15, wherein the fluid is a magnetorheological fluid.

17. The pre-planarization module of claim 14, wherein the compliant layer is one of polyurethane and rubber.

18. The pre-planarization module of claim 14, wherein the abrasive surface includes a plurality of abrasive segments.

19. The pre-planarization module of claim 16, further comprising:

an electromagnetic field generator configured to generate an electromagnetic field proximate to at least a portion of the compliant layer, the electromagnetic field causing the fluid to change from the compliant state to the less compliant state.

20. The pre-planarization module of claim 14, wherein the semiconductor substrate support includes a fluid capable of changing between a compliant state and a less compliant state in response to an electromagnetic field being generated proximate to the fluid.

21. The pre-planarization module of claim 14, wherein the compliant layer is a bladder filled with a polymer, the polymer configured to alternate between a compliant state and a less compliant state.

22. The pre-planarization module of claim 21, wherein the polymer is a magnetorheological polymer.

23. The pre-planarization module of claim 22, further comprising:

an electromagnetic field generator configured to generate an electromagnetic field proximate to at least a portion of the compliant layer, the electromagnetic field causing the polymer to change from the compliant state to the less compliant state.

24. The pre-planarization module of claim 14, wherein the semiconductor substrate support includes a polymer capable of changing between a compliant state and a less compliant state in response to an electromagnetic field being generated proximate to the polymer.